First Year Report

Methods for Integration of Heterogeneous Real-Time Services into High-Performance Networks

Magnus Jonsson and Bertil Svensson

Ph.D. student: Carl Bergenhem

School of Information Science, Computer and Electrical Engineering,
Halmstad University, Box 823, S-301 18 Halmstad, Sweden
email: {magnus.jonsson, bertil.svensson}@ide.hh.se, Phone: +46 35 16 71 00, Fax: +46 35 12 03 48

1. Project summary

There is an industrial need of new high-performance networks with support for the often heterogeneous real-time requirements in emerging (often embedded) applications like multimedia, radar signal processing, and telecommunication applications. This project aims to provide novel methods to satisfy this need. It can, for example, be the support of services for both soft and hard real-time requirements, and with different quality of service demands (e.g., probability of meeting soft deadlines). The integration of services into both existing and novel high-performance networks with special architectural features/support are considered in the project. We have developed a high-bandwidth network which takes advantage of typical new features in novel fiber-optic network architectures, while *methods and protocols with good integrated support for diverse real-time services and QoS* are being considered for the moment.

2. Changes of project plan and achieved results

Roughly speaking, the project plan has not changed so much more than (*i*) the order of different tasks has changed a bit and (*ii*) we will focus more on simulations and not on implementations (for the moment at least) on our network demonstrator. Because of good ideas and to get a good start with the research, a large part of the first year has been dedicated to development of methods, simulation program, analysis etc. The role of our industrial partners has therefore been limited to quite informal contacts, mainly with the project leader. Continuing work for the moment are, among other things, a survey over related research and this will also include industrial needs etc, which will lead to more contacts with our industrial partners. Also worth mentioning is that Jonas Vasell now is connected to both CR&T (one of our project partners) and Halmstad University which has strengthened that contact.

The main results so far are:

- A high-performance network with global deadline scheduling and spatial bandwidth reuse, and with possibilities for diverse time-deterministic services like process synchronization and group communication.
- A computer simulation program for the proposed and similar networks.
- Performance analysis of the proposed network under a broad range of network and traffic parameters.
- Outlines for how to extend or modify the network to support heterogeneous real-time communication services.
- Outlines of how to compare the interaction between different service classes and, hopefully, get some more general understanding of heterogeneous traffic behavior.
- Work on a survey.
- Minor study of different kinds of network traffics to be used in performance evaluations, depending on the art of applications targeted.

3. List of publications

In addition to publications connected to ARTES events, the following papers from the project have been accepted for publication this far:

Bergenhem, C., M. Jonsson, and J. Olsson, "Fibre-ribbon pipeline ring network with distributed global deadline scheduling and deterministic user services," to appear in *Proc. Workshop on Optical Networks (WON'2001) in conjunction with 2001 International Conference on Parallel Processing (ICPP'01),* Valencia, Spain, Sept. 3-7, 2001.

Jonsson, M. and C. Bergenhem, "A Class of Fiber-Ribbon Pipeline Ring Networks for Parallel and Distributed Computing Systems," *Proc. International Conference on Parallel and Distributed Processing Techniques and Applications (PDPTA'2001),* Las Vegas, NV, USA, June 25-28, 2001, vol. IV, pp. 1869-1875.

4. Industrial cooperation

The involvement of our industrial partners during the first year can be summarized as:

- CR&T: Many informal meetings and a planned more formal seminar day soon.
- SUNET/KTH-NOC: In addition to informal contacts, Carl Bergenhem (Ph.D. student in the project) has been visiting them once to learn about their equipment etc and we have had a guest from them a few times, e.g., holding seminars which also have been open to master students etc following network courses. An interesting detail is that they have been looking at a quite new Cisco network strongly related to our research results.
- Ericsson Microwave Systems: Some informal discussions and a more formal seminar day where several of their specialists attended. Both application details and technical solutions were discussed.

In addition to the cooperation with our industrial partners, the project leader presented the project at the ARTES arranged seminar day at ABB in January 2001.